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the American explorer, and eminent authorities upon the Antarctic who are more lenient than Amundsen (such as Dr. H. R. Mill, Dr. W. S. Bruce and Professor von Drygalski) have found in the almost continuous storms and fogs which Wilkes encountered and in the nature of his unstrengthened ships, a sufficient explanation of the inaccuracies in his map. The wavy lines, almost a repeating pattern, which Wilkes entered upon the map for coast, is in itself sufficient indication that he regarded it as approximate only, masked as it generally was by barrier and huge bergs; but his series of soundings, through establishing the existence of a marginal shelf, confirmed his discovery of the land.

Amundsen himself, in entering upon his own map the extension of the Queen Maud Mountains, has indicated a series of peaks extending 150 miles from a single point of observation situated upon the domed surface of the inland ice, and by a conventional symbol not unlike that of Wilkes he has continued the range another fifty miles into the distance. If future exploration should prove that he has been too optimistic in adding the more remote fifty miles of the range, no one would be warranted in saying of his expedition, "it is difficult to say anything definite."

The edition as a whole is well gotten up, but the paper and text illustrations as well as the low price, indicate that the work is intended for a large general sale and not for a library edition. An English edition is to be issued by Murray and an American by Dutton.

NOTES ON THE DESCRIPTION OF LAND FORMS.—VIII*

The Relations of Geography to Geology.

THE TERTIARY GRAVELS OF THE SIERRA NEVADA OF CALIFORNIA. By Walde-
mar Lindgren. *Professional Paper* 73, U. S. Geol. Survey, Washington, 1911.

The greatest contribution to the regional geography of the United States comes at present from the U. S. Geological Survey, in the form of reports, maps and folios. It is not surprising that a large part of this information, in so far as it is presented in words, should be geologically rather than geographically phrased; that is, that it should be worded in such a way as to turn the reader's attention more to the past history of the earth—the proper domain of geology—than to the present condition of its surface—a proper domain of geography;

* Professor Davis's earlier contributions to the *Bulletin* under this title appeared in Vol. 42, 1910, pp. 671-675 and 840-844; Vol. 43, 1911, pp. 46-51, 190-194, 598-604, 679-684 and 847-853.

and it is perfectly natural that the information should be for the most part restricted to one section of the physical half of our subject, namely to land forms, while other sections of the physical half and all the ontographic half of geography should be left almost untouched. Attention is here called to these limitations, not in the least in the way of adverse comment on the well prepared geological reports issued by the Survey, but with the object of impressing our geographers with the importance of two supplementary tasks for which they are responsible: one is to rephrase the geographical material that they find in the Survey publications so as to place the proper emphasis on existing features; the other is to go on from the excellent beginning thus provided and complete the full-fledged geographical treatment of the districts concerned by adding appropriate climatic and ontographic chapters. Because one geographer specializes upon climate, and another upon land forms, and a third and a fourth upon botanical and human problems, it does not follow that any one of these specialists regards his work as constituting the whole of geography or as being more important than any other part; his work is simply the part of geography to which he is, for one reason or another, giving particular attention. If any well prepared student of the entire content of geography will combine all its parts into a well rounded whole, all the specialists will rejoice. Truisms of this kind must sometimes be explicitly stated, so as to correct misunderstandings.

Lindgren's report on the Tertiary gravels of the Sierra Nevada opens with an "outline of the later geological history" of the region, which illustrates very well the kind of non-geographical information that a geographer ought to have, because it serves so well as a background for the facts that he wishes to place in the foreground. Then comes a page on "topography," which seems to have been intentionally restricted to an empirical style, and which is certainly excellent for a description of that kind; it might be quoted as it stands by geographers who prefer the empirical over the explanatory form of treatment. It includes, however, perhaps by accident, a few explanatory phrases, such as "streams have trenched deep canyons" and "a deep basin . . . filled with alluvium"; and in view of this it is difficult to understand why the abrupt eastern slopes of the range are here described simply as "escarpments," instead of as "dissected fault scarps," particularly as the origin of the escarpments by faulting has been explicitly stated a few pages earlier. It is indeed curious why an author, who can with proved competence find his way through the complex geological history of the region, or why a Survey which has done so much towards establishing the verity of the principles of explanatory physiographic description, should hesitate to treat the subject of "topography" in an explanatory manner, instead of implying by the adoption of an empirical treatment that in their opinion such treatment is the proper one for use in a "professional paper" for expert readers.

Thirty pages with excellent plates treat of "general geology," and this treatment is, of course, in thorough-going explanatory style. These are followed by several more pages, giving a "summary of the history of the range." Then comes the main body of the paper, describing the gravels more in detail and including separate chapters for each map quadrangle. Many paragraphs here merit a geographer's study, but it is in the preceding pages that he can most directly learn what he ought to know in order to prepare an explanatory physiographic description of the central and northern parts of the Sierra. No better exercise can be given to an advanced student, who wishes to gain expertness in such description, than to rephrase the pertinent parts of this report in a geographical style, whereby the attention shall be held upon existing features, instead of being directed to the successive stages of their past history.

The range consists of a great mass of folded sediments, intruded by granites; the structural trends are from north-northwest to south-southeast. Three cycles of erosion are recognized, the second being closed by deposition of gravels and eruption of lavas before the opening of the third. Flat-topped ridges and highlands of gentle outline, sometimes surmounted by monadnocks especially along what was probably then the crest of the range, tell of the long continued erosion of the first cycle, whereby the lofty mountains initiated by folding and intrusion were for the most part planed down to a surface of comparatively small relief. The present westward slope of the undulating highlands and their abrupt eastward termination by dissected fault scarps, somewhat on the interior side of the supposed earlier crest line, indicate the monoclinical tilting by which the second cycle was introduced. The erosion next performed is proved by the mature transverse and longitudinal valleys, 1,000 or 2,000 feet deep, whereby the highlands are abundantly dissected and in some places reduced to narrow hard-rock ridges; the best preserved highlands are in the granite areas, while some of the ridges follow greenstone belts near the present western base of the range; but a weaker granodiorite area was reduced to low relief and now rises gradually from the valley-plain of California, thus serving as a path of first ascent for the Central Pacific railroad. Heavy gravel beds, repeated lava flows, and broad floods of tuffs and breccias aggrade the mature valleys of the dissected highland. The work of the third or current cycle is seen in the narrow, steep-side canyons eroded from 1,000 to 4,000 feet beneath the gravels and lavas in the earlier mature valleys, the form of which is sometimes shown in section in the canyon walls. The dislocation of certain lava flows on the line of the eastern scarps, some of which now measure 5,000 or 6,000 feet in height, shows that the earlier faulting was renewed, probably about contemporaneous with the revival of erosion on the western slope; but the author insists that the renewed faulting is alone not sufficient to produce the increased slope of the canyon-cutting rivers.

German Adoption of Explanatory Descriptions.

BEGLEITWÖRTE ZU DEN "40 BLÄTTERN DER KARTE DES DEUTSCHEN REICHES 1:100,000, ausgewählt für Unterrichtszwecke, herausgegeben von der königlich Preussischen Landesaufnahme." By Walter Behrmann (*Zeitsch. Ges. f. Erdk.* Berlin, 1911, 601-624, 677-701).

As a sequel to the recent completion of the 1:100,000 map of Germany, forty sheets selected by the Prussian Survey office are offered for sale to German schools for six marks; and the Geographical Society of Berlin will add to each set a copy of the explanatory text, above cited. This liberal action must contribute to the further cultivation of geography in a country where its study is already far advanced, and all the more because an explanatory style of description has been adopted in the semi-official "Begleitworte." At the same time it is interesting to note that the chief difficulty which Behrmann found in preparing his text, which is intended for teachers and students, was due to "the insufficient morphological investigation of the Fatherland"; he met in the study of the maps many problems which are not yet discussed in geographical literature. Among numerous excellent examples, mention may be made of Sheet 46, Neustadt in West Prussen (northwest of Danzig), which includes a well defined meandering valley, incised in drift and abandoned by the large river that eroded it—probably the Vistula, when it was reinforced by ice-water and deflected westward by the retreating ice sheet—the valley now being occupied only by small streams, two of which have deposited fans on its floor opposite the ravines that they have eroded in the bordering uplands. Sheet 336, Goslar, includes the northern border of the Harz and the adjacent lowland; the Harz mass is a fault block, consisting of strongly folded Paleozoic rocks, trending southwest-northeast, and showing a highland, 500-600 meters, of subdued forms ("eingerumpft," indicating a less advanced stage of erosion than "eingeebnet"), surmounted by the granitic monadnock of the Brocken, 1,142 meters, bordered by a fault-scarp, and sharply dissected since its uplift. The piedmont area consists of inclined Mesozoic strata, trending northwest-southeast, reduced to longitudinal lowlands and ridges of small relief.

Sheets 469, Annaberg, and 494, Wiesenthal, present the gentle northward slope and the sharply dissected interior fault-scarp of the Erzgebirge, the mass of which consists of deformed schists and gneiss reduced to an old surface, now seen as an uplifted peneplain, surmounted by basalt mesas capping sandstones elsewhere stripped away; the slanting peneplain is incised by consequent streams, the headwaters of which still flow in shallow highland valleys, while the middle stretches are more deeply incised, sometimes with meandering courses (and the lower parts are shallower again near the northern base of the mountains). The crest is moor-covered, and surmounted by (residual?) summits; the southeastern scarp, of simple or compound displacement, 4-500 meters in relief, is strongly dissected; large fans are spread out beneath its ravines,

sometimes covering a lowland of crystalline rocks like those in the mountain crest. Sheet 504, Cochem, shows the central highlands of the Schiefergebirge, which consist of folded Paleozoic strata, striking northeast-southwest, reduced to a peneplain, above which quartzite ridges survive as [linear] monadnocks and on which the Mosel once flowed in a freely meandering course; a post-Miocene uplift caused deep incision by the meandering river; the spurs entering its curves exhibit finely developed undercut and slip-off slopes (*Prall- und Gleithänge*); the side streams cut sharp ravines. A belt of weak strata, a little north of the Mosel, has been etched out to a lowland, known as the Wittlicher Senke. Other examples show the dissected fault-scarps of the Odenwald (558), Schwarzwald (644), and Vosges (642); the *cuestas* (*Stufe*) near Metz (568), and south of Stuttgart (590, 606); the capture of a Danube branch by the Wutach (645), and so on.

The explanatory terminology, although here carried much farther than is usual in German essays, is not always uniform. Consequent rivers are described as *konsequent*, *Schichtflüsse*, and *Abdachungsflüsse*; subsequent is used rarely, although streams and valleys of subsequent origin are often mentioned. The time-names of geological formations are reduced to what may be called a German minimum, for their number is far below the measure ordinarily found in the geographical articles of German authors over-learned in geology. The use of such terms as Paleozoic and Mesozoic, intentionally repeated in the above abstracts so as to preserve the flavor of the original, is unfortunate, because it will give to the teachers and students of geography, to whom the *Begleitworte* are addressed, the impression that a geographical end is best served by mentioning the age of the formations concerned; whereas what the geographer needs, in forming his conception of the landscape, is not the geological age of the underlying rocks, but their composition and attitude. When it is said that the Schiefergebirge suffered "a post-Miocene uplift" the reader's thoughts are more or less turned aside from their proper course; what he needs to know is not the geological date of the uplift, but the present stage of dissection of the uplifted mass. It may be briefly noted that the bordering escarpment of the Harz is probably not, as here described, a fault-scarp in the sense that it was directly produced by faulting, but a fault-line scarp, in the sense that it has been produced by the action of erosion in removing the weaker part of a faulted mass and exposing the formerly subterranean fault-surface of the stronger part.

Rational Geography.

THE GEOGRAPHY OF GODAVARI—A DISTRICT IN INDIA. By S. W. Cushing. *Bull. Geogr. Soc. Philadelphia*, Vol. ix, 1911, pp. 7-25.

The Carnatic lowland along the eastern border of India has been described on the basis of scanty statements in the publications of the Geological Survey of India, as a young coastal plain, and as such has been regarded as an im-

portant member of its class. Opportunity for its further study came through the appointment of S. W. Cushing, of the State Normal School at Salem, Mass., to a Sheldon fellowship of Harvard University, whereby he was enabled to visit India two years ago and examine the Carnatic with some care, with the result of discovering that it possesses more varied features than had been supposed. A preliminary report of his work, quoted above, may be cited as a thoroughly rational treatment of a problem in regional geography. It first gives six pages to an explanatory physiographic account of the Godavari district; it then presents several sections on the relation of the physiographic features to the distribution, density and occupations of the people, to religion and to means of transportation. A section on climate might be advisedly added.

The six pages on land forms give a lucid account of the elevated and dissected peneplain of the inner highland, or Eastern Ghats, and their isolated outliers; of the great slope, apparently a huge sea cliff, by which a descent of 2,000 feet is made from the highland to the Carnatic lowlands, and of the three longitudinal divisions of the lowlands. The inner division, some twelve miles wide, is regarded as a plain of marine denudation, cut across the same metamorphic rocks that rise in the Ghats; the middle division is a mature belted coastal plain, about ten miles wide, with one or more *cuestas* rising outside of its inner lowland; and the outer division is a low and young coastal plain, with smooth surface and dune-bordered shore line. The Godavari river cuts across all these features, and has built a large projecting delta-plain. The verbal description is easily understood alone; but it is made still more readily intelligible by good photographs and especially by a well-designed but rather roughly executed block diagram, the value of which is so great that it must encourage other geographers to give similar graphic aids to their text. Practically all the elements of the topography are thus brought into systematic relation with one another; the physiography of the whole district is concisely described, effectively illustrated and easily conceived.

In the ontographic sections of the article, many items are brought into causal connection with appropriate physical features, and thus the entire geographical story is well knit together. How can a better idea of the location of a village be given than by saying that it stands "on a partial bridge of sandstone extending from the principal *cuesta* toward the oldland"? How can the opportunities for irrigation be better set before the reader than by generalizing them in a special block diagram, which with the text shows in the clearest manner how the "tanks" or reservoirs are related to the consequent, subsequent and obsequent streams of the *cuestas*. And yet the possibility of thus concisely pointing out the relation of human occupations to physiographic environment rests on a method of study which a British geographer has lately characterized as "an insane concentration on land forms." Mr. Cushing's fuller report will be looked for with interest.

W. M. DAVIS.